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FLOOD INSURANCE STUDY

COUNTY OF MORRISON, MINNESOTA

UNINCORPORATED AREAS

DECEMBER 15, 1980

federal emergency management agency
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COMMUNITY NUMBER - 270617

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Flood Boundary and Floodway Map

PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index
Flood Insurance Rate Map

FLOOD INSURANCE STUDY

MORRISON COUNTY,
UNINCORPORATED AREAS, MINNESOTA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the unincorporated areas of Morrison County, Minnesota, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert the unincorporated areas of Morrison County to the regular program of flood insurance by the Federal Insurance Administration (FIA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.1 (d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Barr Engineering Company for the Federal Insurance Administration, under Contract No. H-4539. This study was completed in October 1979.

1.3 Coordination

Streams requiring detailed and approximate study were identified at an initial coordination meeting on October 10, 1978, and a time and cost meeting on May 4, 1977. These meetings were attended by representatives of the FIA, the Minnesota Department of Natural Resources, the Study Contractor, and Morrison County. Base maps were obtained from the Minnesota Department of Transportation. Flood discharges for the detailed

studies were coordinated with the Hydrologic Review Committee consisting of representatives of the Minnesota Department of Natural Resources, the Soil Conservation Service (SCS), the U.S. Army Corps of Engineers (COE), and the U.S. Geological Survey (USGS), and county officials.

On March 26, 1980, the results of the work by the Study Contractor were reviewed and accepted at a final coordination meeting attended by representatives of the FIA, the Study Contractor, and Morrison County.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the unincorporated areas of Morrison County, Minnesota. The area of study is shown on the Vicinity Map (Figure 1).

The areas studied by detailed methods were selected with priority given to all known flood hazard areas, and areas of projected development or proposed construction through October 1984.

Approximate methods of analysis were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to and agreed upon by the FIA and representatives of Morrison County.

The flooding sources studied by detailed methods are listed below:

a. the Skunk River from the north line of Section 29 R3OW T40N (about one mile above State Highway 25), to County Highway 39;

b. the Little Elk River from County Road 211 to the eastern corporate limit of the City of Randall;

c. the Swan River from the southern corporate limit crossing of the City of Sobieski to County Highway 18; and

d. the Platte River from State Highway 27 to the confluence with Little Mink Creek.

The flooding sources studied by approximate methods included: the Mississippi River; Buckman Creek; the Skunk River; the Little Elk River; the South Branch Little Elk River; the North Branch Little Elk River; the Crow Wing River; the Long Prairie River; Little Mink Creek; Big Mink Creek; Rice Creek; the Two Rivers River; the Swan River; the Platte River; Sullivan Lake; Platte Lake; Skunk Lake; Rice Lake; and Fletcher Creek.

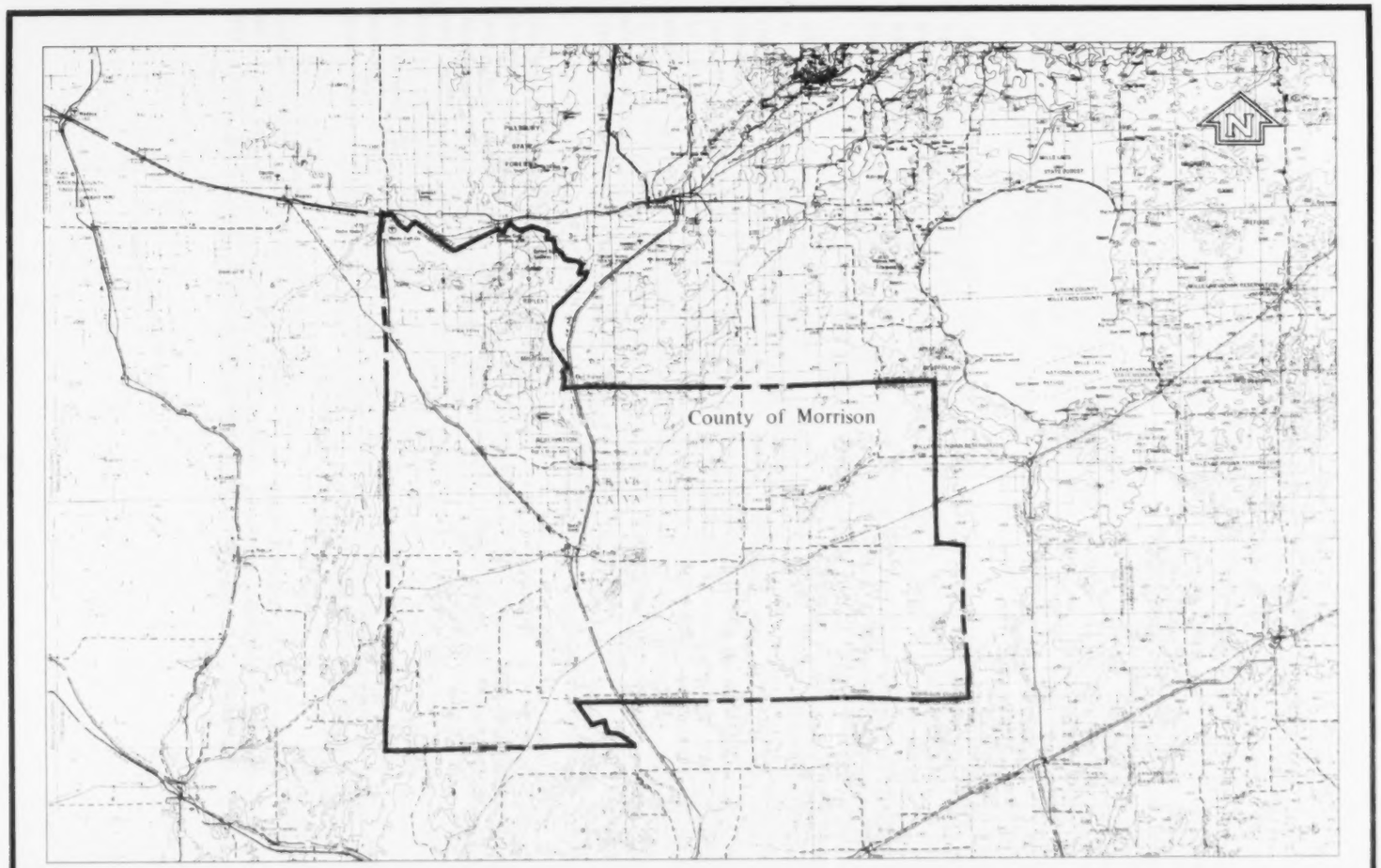

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

COUNTY OF MORRISON, MN
(UNINCORPORATED AREAS)

APPROXIMATE SCALE
10 0 10 20 30 MILES

VICINITY MAP

The following approximate study areas were reviewed but flood hazard areas were not delineated because of the absence of significant flood hazards: Buckman Creek; Big Mink Creek; Little Mink Creek; Rice Creek; the South Branch Two Rivers; the North Branch Two Rivers; Taylor Creek; and Irish Creek.

2.2 Community Description

Morrison County is centrally located in the State of Minnesota, approximately 100 miles northwest of the Minneapolis/St. Paul area. Morrison County is bounded on the north by Cass and Crow Wing Counties, on the east by Mille Lacs County, on the south by Benton and Stearns Counties, and on the west by Todd County. The 1970 population of Morrison County was 26,949 (Reference 1).

The average monthly summer high temperature in Morrison County is 81 degrees Fahrenheit (F.), while the average monthly summer low temperature is 56 degrees F. The average monthly winter high temperature is 23 degrees F., while the average monthly winter low is three degrees F. The average annual snowfall is approximately 40 inches per year, while the average annual rainfall is approximately 26 inches per year (Reference 2).

The topography of Morrison County is rolling, sloping gently from the county's outer borders to the Mississippi River. The average elevation is about 1,250 feet above sea level, with the highest elevation, 1,450 feet, located in the north-central part of the county (References 3, 4, 5, and 6). The western edge of the county is hilly, being typical of terminal morainal landscapes. The central and eastern portions of the county are typical of flat to rolling till plains with eskers and drumlins (Reference 7). Soils beneath wooded portions of north and central Morrison County are generally sandy and well-drained. Loamy, level, poorly drained soils, such as peats and mucks, lie beneath marshland areas. Agricultural regions in the south and east contain loamy, well-drained soils (Reference 7).

Land use in Morrison County is comprised of the following categories: agricultural comprises 60 percent, or 689 square miles; forest and marsh comprises 36 percent, or 424 square miles; residential, commercial, and recreation comprise two percent, or 21 square miles; lakes and rivers comprise two percent, or 21 square miles; and transportation comprises less than one percent, or one square mile (Reference 8). The majority of the county is agricultural cropland, with principal crops being corn, small grain, and forage crops. Swamps, marshes, deciduous woodlands, and conifers are found in the northern portion of the county. Forested areas are found along the many rivers and streams in the county.

Drainage in Morrison County is provided by the Mississippi River, which bisects the county north to south. Major tributary river systems to the Mississippi River in Morrison County include the Crow Wing River, the

Platte River, the Little Elk River, the Swan River, Fletcher Creek, and the Two Rivers River.

Some land near Little Falls has been designated for future residential development. Also, tracts of land around existing communities, especially Little Falls, and along major highways and railways have been designated for industrial or commercial development. Scattered farmsteads occur within the flood plain throughout Morrison County. There is little development within the flood plain adjacent to communities in Morrison County. On Sullivan Lake, in the northwest corner of Morrison County, a number of summer recreational cabins lie within the flood plain.

2.3 Principal Flood Problems

Rapid snowmelt may cause significant flooding in the spring. Intense rainfalls of long duration may also cause major floods. Water-surface elevations may be influenced by ice buildup at structures.

The Little Elk River experienced a major flood in July 1972. Significantly greater than a 500-year event, the storm of July 1972 delivered the greatest 24-hour rainfall in recorded Minnesota history (Reference 7). In the detailed study reach, high water elevations ranging from 1,144.03 (at the County Road 211 bridge) to 1,160.03 (at the County Road 209 bridge) were recorded by the COE (Reference 9). Damage was limited to cropland and roads.

The Platte River experienced major flooding in July 1972, April 1975, and March 1976 (Reference 10). The July 1972 flood was approximately a 100-year flood. Damage from the 1972 flood was limited to cropland and roads.

The Skunk River experienced a major flood in July 1972 which was approximately a 100-year flood (Reference 10). High water elevations in the detailed study reach ranging from 1,141.35 at the County Road 38 bridge to 1,160.09 on the County Road 39 bridge were recorded by the COE. Agricultural cropland and roads were damaged.

The Swan River experienced a major flood in July 1972 which was approximately a 50-year event (Reference 10). Roads and cropland were damaged.

2.4 Flood Protection Measures

There are no significant flood protection structures in existence in Morrison County at this time and none are planned.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required

for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one percent chance of annual occurrence) in any 50-year period is about 40 percent (four in ten), and for any 90-year period, the risk increases to about 60 percent (six in ten). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail affecting the community.

The hydrologic analysis of the Little Elk River was based on an analysis of the watershed using the SCS computer program, TR-20 (Reference 11). Watershed characteristics for the TR-20 program were based on USGS quadrangle and topographic maps of the area, a Minnesota Department of Transportation index of structures, and field inspection of the area (References 3, 4, 5, and 6). Precipitation data were obtained from the U.S. Weather Bureau's TP-40 (Reference 12) and 10-day snowmelt runoff data were obtained from the National Engineering Handbook (Reference 13).

The Skunk River discharges for detailed study portions of the Skunk River were obtained by HEC-1 using a synthetic unit hydrograph (Reference 14). This synthetic unit hydrograph was derived by reconstituting the July 1972 storm hydrograph of Hillman Creek at the crest stage partial record station near Pierz. This station has been in operation since 1974. Rainfall data were obtained from the U.S. Weather Bureau's TP-40 (Reference 12). Discharges for approximate study portions of the Skunk River were determined based on Minnesota Department of Transportation regional discharge curves with curve numbers being selected consistently with discharges used on the detailed study portions of the river (Reference 15).

The discharges for the detailed study portion of the Swan River were determined using HEC-1 (Reference 14). A partial record stream gage, located approximately 1.5 miles west of Sobieski has been operated since 1968. A unit hydrograph for use in HEC-1 was developed by reconstituting

the storm of July 1972 based on discharge records from this station. Rainfall amounts for use in HEC-1 were determined from the Weather Bureau's TP-40 (Reference 12). Discharges were coordinated with discharges used in the Flood Insurance Study for the City of Sobieski (Reference 16). Discharges for approximate study portions of the Swan River were determined based on Minnesota Department of Transportation regional discharge curves with curve numbers being selected consistent with discharges used for the detailed study portions of the river (Reference 15).

Discharges for the detailed study portion of the Platte River were determined by multiplying discharges determined for study portions of the Skunk River by a drainage area ratio taken to a regional exponent. Discharges for the detailed study portion of the Skunk River, as explained above, were determined using a synthetic unit hydrograph (Reference 14). Discharges for approximate study portions of the Platte River were determined based on Minnesota Department of Transportation regional discharge curves with curve numbers being selected consistent with discharges used on the detailed study portion of the river (Reference 15).

Discharge data used to determine detailed flooding in Morrison County for the Mississippi River and the South Branch Little Elk River were obtained from the City of Little Falls, Minnesota, and the City of Randall, Minnesota, Flood Insurance Studies, respectively (References 17 and 18).

Discharges for approximate study portions of the Mississippi River were coordinated with the City of Little Falls, Minnesota, Flood Insurance Study (Reference 17). Discharges for the other approximate study areas in Morrison County were determined using Minnesota Department of Transportation regional discharge curves, with drainage areas determined from SCS watershed inventory maps, and USGS quadrangle maps (References 15, 19, 3, 4, 5, and 6).

Peak discharges for the 10-, 50-, 100-, and 500-year floods of each flooding source studied in detail in the community are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
SKUNK RIVER					
Upstream of Confluence with Hillman Creek	53.7	1,540	2,180	2,480	3,100
Downstream of Confluence with Hillman Creek	100.4	2,930	4,150	4,730	6,050
LITTLE ELK RIVER					
County Road 211	113.2	2,120	2,775	3,045	3,700
SWAN RIVER					
County Highway 18	115	1,230	2,120	2,690	4,050
PLATTE RIVER					
At State Highway 27	157	2,360	3,350	3,800	5,150

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the streams in the community were carried out to provide estimates of the elevations of the floods of the selected recurrence intervals along each flooding source studied in detail.

Cross sections for the detailed study streams were obtained from field survey. Cross sections for the approximate study areas were taken from USGS maps (References 3, 4, 5, and 6).

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Roughness coefficients (Manning's "n") used in the hydraulic analyses were assigned on the basis of field reconnaissance and the above referenced maps. The following ranges of roughness coefficients were used for the streams studied in detail:

Location	Roughness Values: Channel	Overbank
Skunk River	0.035-0.040	0.050-0.070
Little Elk River	0.032-0.050	0.060-0.120
Swan River	0.040	0.090
Platte River	0.035	0.040-0.130

Starting water-surface elevations for the flooding sources studied in detail were developed using the slope-area method (Reference 20). The step-backwater computer program HEC-2 was used for computing flood elevations on the detailed study portions of the Little Elk River, the Skunk River, the Platte River, and the Swan River (Reference 20). Elevations used to determine detailed flooding in Morrison County for the Mississippi River and the South Branch Little Elk River were obtained from the City of Little Falls, Minnesota, and the City of Randall, Minnesota, Flood Insurance Studies, respectively (References 17 and 18). Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals (Exhibit 1).

Approximate flood elevations were taken from high water marks for the 1972 flood. In the absence of high water marks, Manning's equation was used with cross sectional geometry, as identified by topographic maps (References 3, 4, 5, and 6).

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations as shown on the profiles are, therefore, considered valid only if hydraulic structures, in general, remain unobstructed and if channel and overbank conditions remain essentially the same as ascertained during this study.

All elevations are referenced from National Geodetic Vertical Datum of 1929 (NGVD); elevation reference marks used in the study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FIA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to

indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100-year and the 500-year floods have been delineated using the elevations determined at each cross section; between cross sections the boundaries were interpolated using quadrangle maps photoenlarged to a scale of 1:12000, with contour intervals of 10 and 20 feet (References 3, 4, 5, and 6). Approximate study streams were also delineated on the above referenced maps.

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 2). Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to lack of detailed topographical information or to limitations of the map scale, such areas are not shown. In cases where the 100-year and the 500-year flood boundaries are close together, only the 100-year boundary has been shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights. Minimum standards of the FIA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. In Minnesota, however, flood plain encroachment is limited by Minnesota Regulations to that which would cause a 0.5-foot increase in flood heights above prefloodway conditions at any point (Reference 21). Floodways having no more than a 0.5-foot surcharge were delineated for this study.

On the Little Elk River, the Skunk River, the Swan River, and the Platte River, the step-backwater computer program HEC-2 was used to compute a surcharge on encroached flow cross sections (Reference 20).

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations were tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 2). There were no existing floodway selections for the Skunk River, the Little Elk River, the Swan River, or the Platte River.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION		
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	WITH FLOODWAY (NGVD)	WITHOUT FLOODWAY (NGVD)	DIFFERENCE
SKUNK RIVER							
A	1.00	530	4280	1.1	1140.0	1139.5	0.5
B	1.68	470	2860	1.7	1140.5	1140.0	0.5
C	2.13	460	2970	1.6	1141.0	1140.5	0.5
D	2.39	910	6090	0.8	1141.2	1140.7	0.5
E	3.11	550	2220	2.1	1143.0	1142.5	0.5
F	3.82	380	1550	3.1	1145.1	1144.8	0.3
G	4.56	200	1520	3.1	1151.3	1151.1	0.2
H	4.89	310	2280	2.1	1151.8	1151.4	0.4
I	5.83	480	2230	1.1	1155.2	1154.7	0.5
J	6.16	350	1170	2.1	1155.9	1155.5	0.4
K	6.37	120	770	3.2	1156.6	1156.4	0.2
PLATTE RIVER							
A	3100[2]	640	3970	1.0	1115.2	1114.7	0.5
B	5480[2]	310	2040	1.9	1115.6	1115.1	0.5
C	7500[2]	650	3280	1.2	1115.9	1115.4	0.5
D	9870[2]	290	1840	2.1	1116.5	1116.0	0.5
SWAN RIVER							
A	27,530[3]	130	1100	2.4	1124.1	1123.6	0.5
MISSISSIPPI RIVER							
A	40,860[4]	996[5]	12,730	3.3	1092.2	1092.0	0.2

[1]MILES ABOVE STATE HIGHWAY 25
[2]FEET ABOVE STATE HIGHWAY 27
[3]FEET ABOVE STATE HIGHWAY 238
[4]FEET ABOVE BLANCHARD DAM
[5]THIS WIDTH EXTENDS WITHIN LITTLE FALLS

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

COUNTY OF MORRISON, MN
(UNINCORPORATED AREAS)

FLOODWAY DATA

SKUNK RIVER - PLATTE RIVER - SWAN RIVER - MISSISSIPPI RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION		
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	WITH FLOODWAY (NGVD)	WITHOUT FLOODWAY (NGVD)	DIFFERENCE
LITTLE ELK RIVER							
A	4135	1400	6660	0.5	1144.6	1144.1	0.5
B	7310	1150	3500	0.9	1145.5	1145.0	0.5
C	13,340	950	4030	0.8	1149.3	1148.8	0.5
D	18,810	650	3170	1.0	1151.8	1151.4	0.4
E	23,420	700	2970	1.0	1152.8	1152.3	0.5
F	28,680	310	1170	2.6	1156.0	1155.5	0.5
G	32,680	190	1610	1.9	1161.3	1160.9	0.4
H	35,020	920	4210	0.7	1161.6	1161.1	0.5
I	38,960	240	1310	2.3	1162.4	1161.9	0.5
J	41,470	110	780	3.9	1163.6	1163.1	0.5

[1]FEET ABOVE COUNTY ROAD 211

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

COUNTY OF MORRISON, MN
(UNINCORPORATED AREAS)

FLOODWAY DATA

LITTLE ELK RIVER

Floodway data in Morrison County for the Mississippi River and the South Branch Little Elk River were obtained from the City of Little Falls and the City of Randall Flood Insurance Study, respectively (References 17 and 18).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 0.5 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

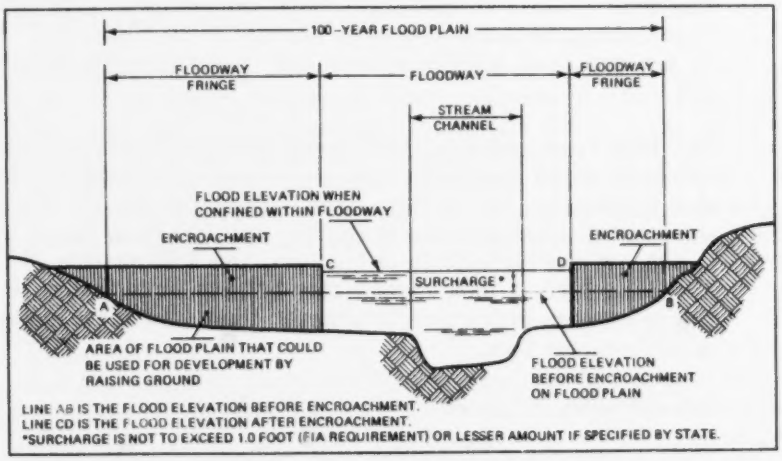
100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE *
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT.
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT.
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FIA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FIGURE 2 - Floodway Schematic

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FIA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHF), and flood insurance zone designations for each flooding source affecting the unincorporated areas of Morrison County.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface

elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

Average Difference Between 10- and 100-year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the unincorporated areas of Morrison County are shown on the Flood Profiles (Exhibit 1) and are summarized in the Flood Insurance Zone Data Table (Table 3).

5.2 Flood Hazard Factors

The FHF is used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest 0.5 foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the unincorporated areas of Morrison County were divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A: Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations are shown or FHFs determined.

Zones A1-A4, A7: Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations are shown, and zones subdivided according to FHF.

Zone B: Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; or areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.

Zone C: Areas of minimal flooding.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the unincorporated areas of Morrison County is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FIA.

6.0 OTHER STUDIES

The approximate study delineation of the Mississippi River in the Morrison County Flood Insurance Study has been coordinated with delineations in the Benton County, City of Little Falls, and City of Royalton Flood Insurance Studies (References 22, 17, and 23).

Discharges, delineations, and profiles for the Little Elk River in Morrison County are in exact agreement with the City of Randall Flood Insurance Study (Reference 18). Discharges, delineations, and profiles for the Swan River in Morrison County were coordinated with the City of Sobieski Flood Insurance Study and are in exact agreement (Reference 16).

Flooding studied in detail for the Mississippi River in the City of Little Falls Flood Insurance Study and for the South Branch Little Elk River in the City of Randall Flood Insurance Study is in exact agreement with this Flood Insurance Study (References 17 and 18).

This study does not agree with USGS Flood Prone Area Maps due to the more detailed nature of this study (Reference 24).

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
SKUNK RIVER							
REACH 1	0305	–1.2	–0.3	0.7	010	A2	VARIES–SEE MAP
REACH 2	0305	–2.0	–0.5	1.2	020	A4	VARIES–SEE MAP
PLATTE RIVER							
REACH 1	0285	–1.7	–0.5	1.6	015	A3	VARIES–SEE MAP
SWAN RIVER							
REACH 1	0270	–2.2	–0.8	1.5	020	A4	VARIES–SEE MAP

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE
[3]ROUNDED TO NEAREST FOOT

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

COUNTY OF MORRISON, MN
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

SKUNK RIVER - PLATTE RIVER - SWAN RIVER

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
MISSISSIPPI RIVER							
REACH 1[4]	0280	–3.5	–1.0	2.3	035	A7	VARIES–SEE MAP
LITTLE ELK RIVER							
REACH 1	0160,0170	–0.7	–0.2	0.4	005	A1	VARIES–SEE MAP
REACH 2	0160	–1.6	–0.4	0.8	015	A3	VARIES–SEE MAP
SOUTH BRANCH LITTLE ELK RIVER							
REACH 1[5]	0160	–1.0	–0.3	0.5	010	A2	VARIES–SEE MAP

[1] FLOOD INSURANCE RATE MAP PANEL
[2] WEIGHTED AVERAGE
[3] ROUNDED TO NEAREST FOOT
[4] DATA FOR THIS REACH TAKEN FROM CITY OF LITTLE FALLS, MINNESOTA FIS
[5] DATA FOR THIS REACH TAKEN FROM CITY OF RANDALL, MINNESOTA FIS

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

COUNTY OF MORRISON, MN
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

MISSISSIPPI RIVER - LITTLE ELK RIVER - SOUTH BRANCH LITTLE ELK RIVER

A Flood Hazard Boundary Map has been published by the Federal Insurance Administration (Reference 25). The differences between the Flood Hazard Boundary Map and this study are justified due to the more detailed nature of this Flood Insurance Study.

This report either supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the National Flood Insurance Program.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic and other pertinent data used in this study can be obtained by contacting the Insurance and Mitigation Division, Federal Emergency Management Agency, One North Dearborn Street, Chicago, Illinois 60602.

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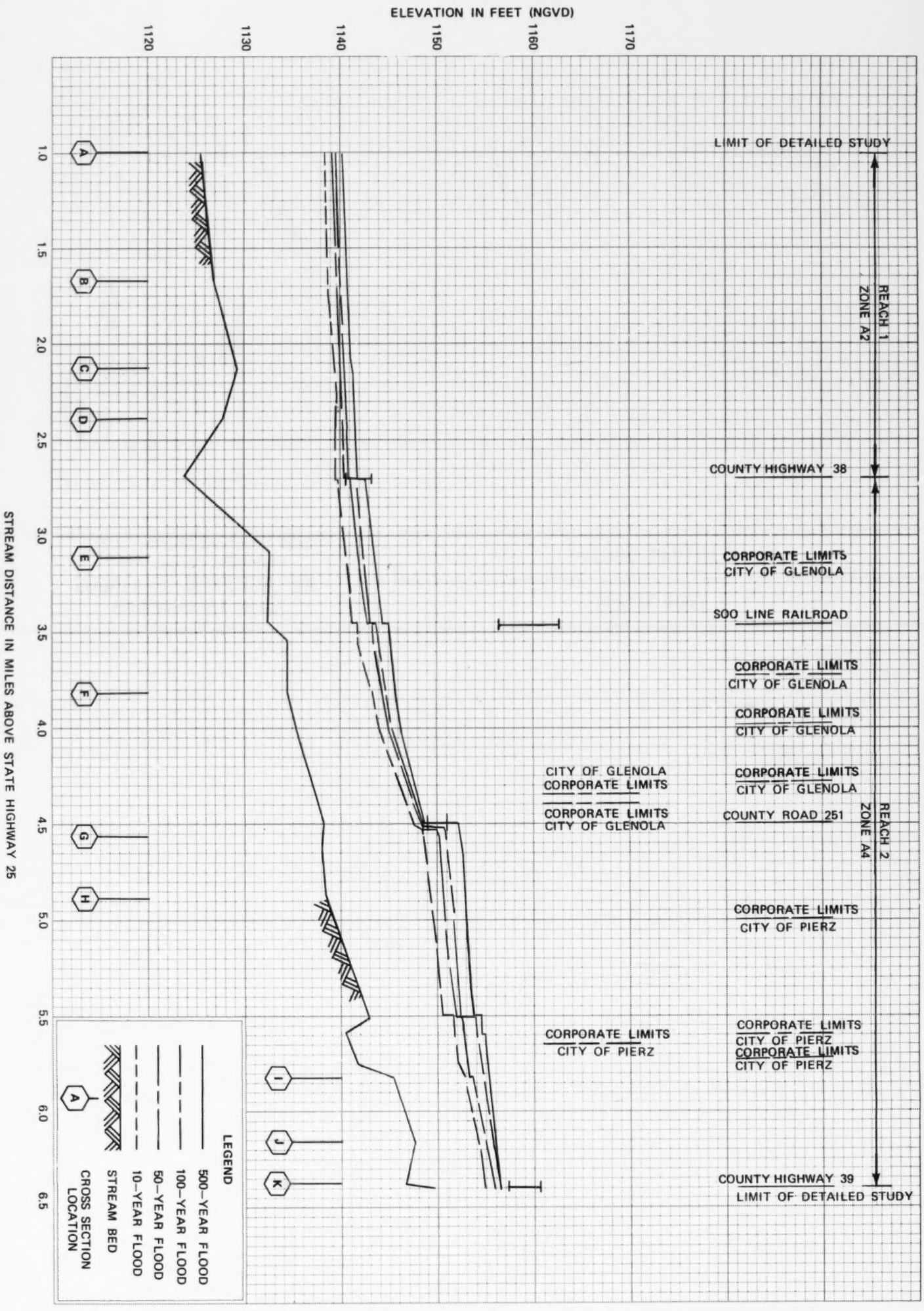


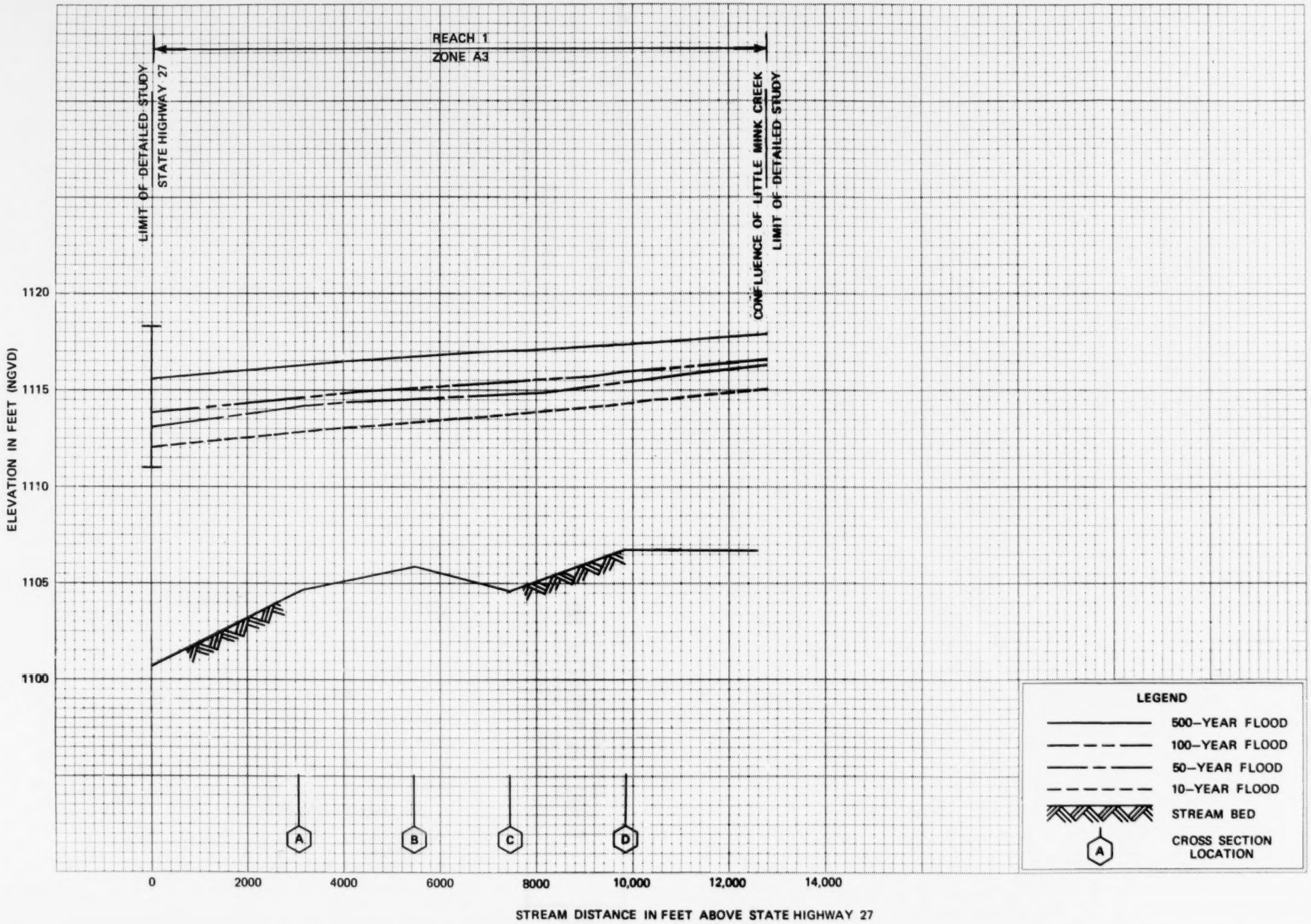
01P

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

COUNTY OF MORRISON, MN
(UNINCORPORATED AREAS)

FLOOD PROFILES

SKUNK RIVER



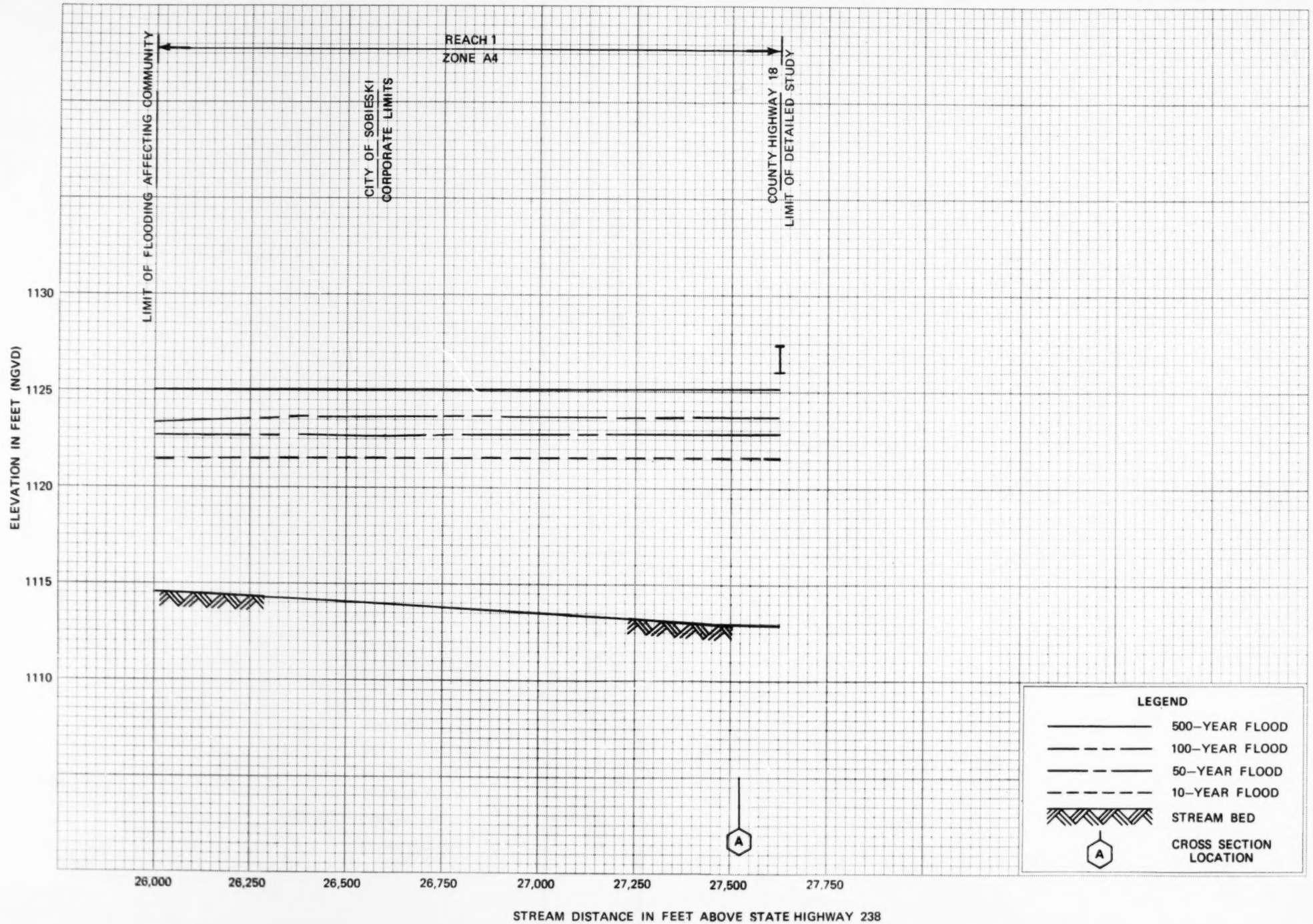
FLOOD PROFILES

PLATTE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

COUNTY OF MORRISON, MN
(UNINCORPORATED AREAS)

02P



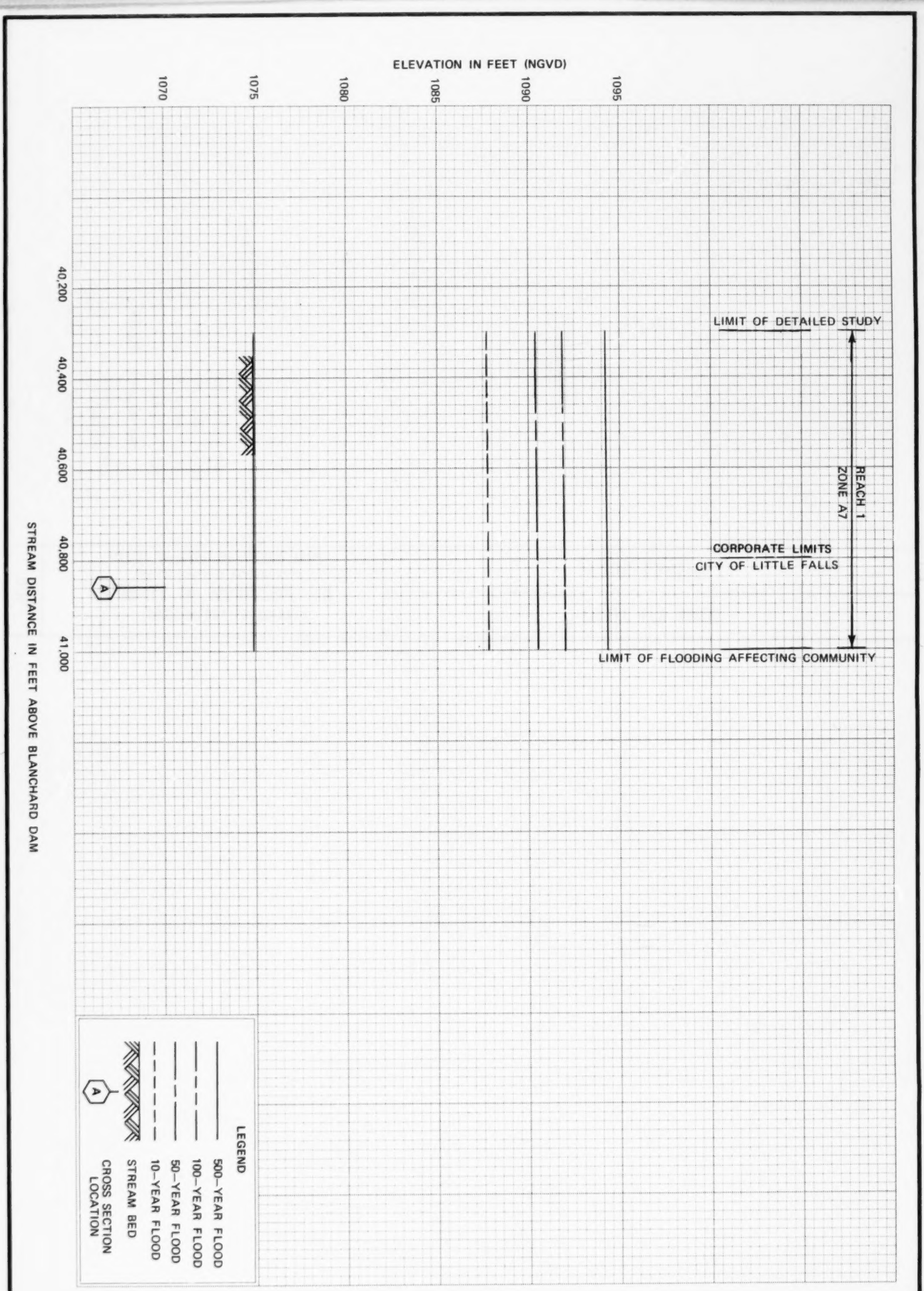
FLOOD PROFILES

SWAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

COUNTY OF MORRISON, MN
(UNINCORPORATED AREAS)

03P



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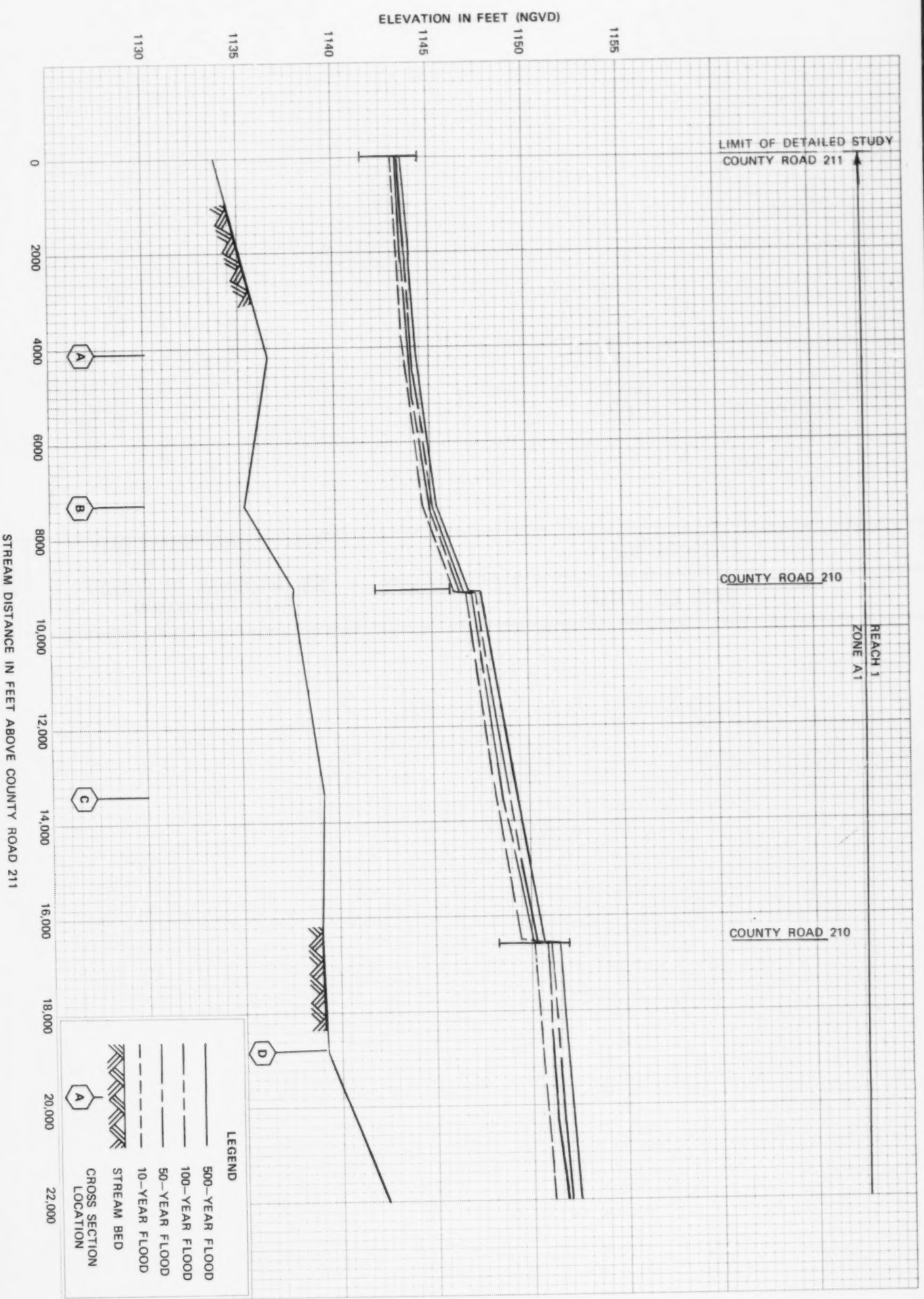
FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration
COUNTY OF MORRISON, MN
(UNINCORPORATED AREAS)

FLOOD PROFILES

MISSISSIPPI RIVER



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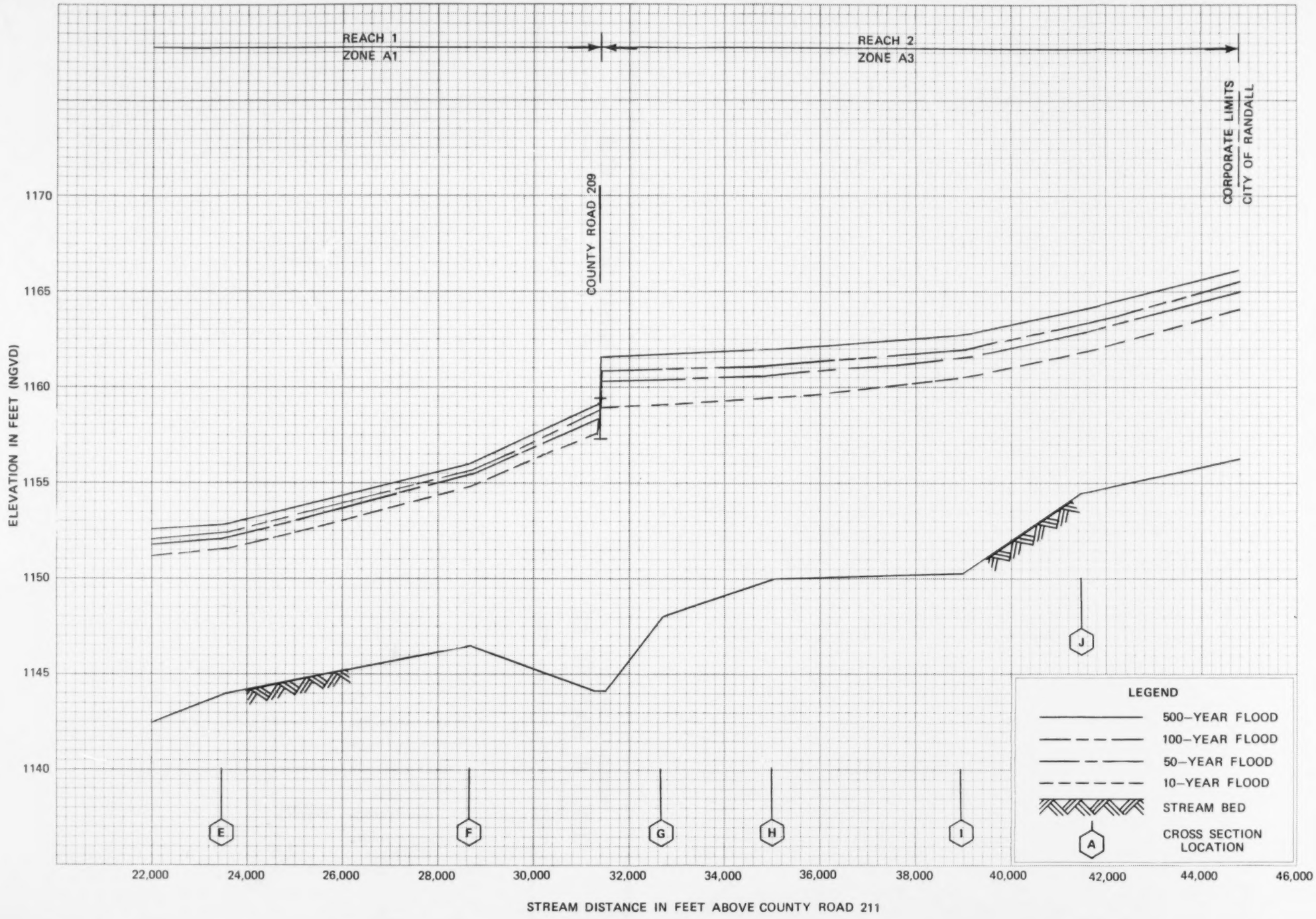
FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration
COUNTY OF MORRISON, MN
(UNINCORPORATED AREAS)

FLOOD PROFILES

LITTLE ELK RIVER



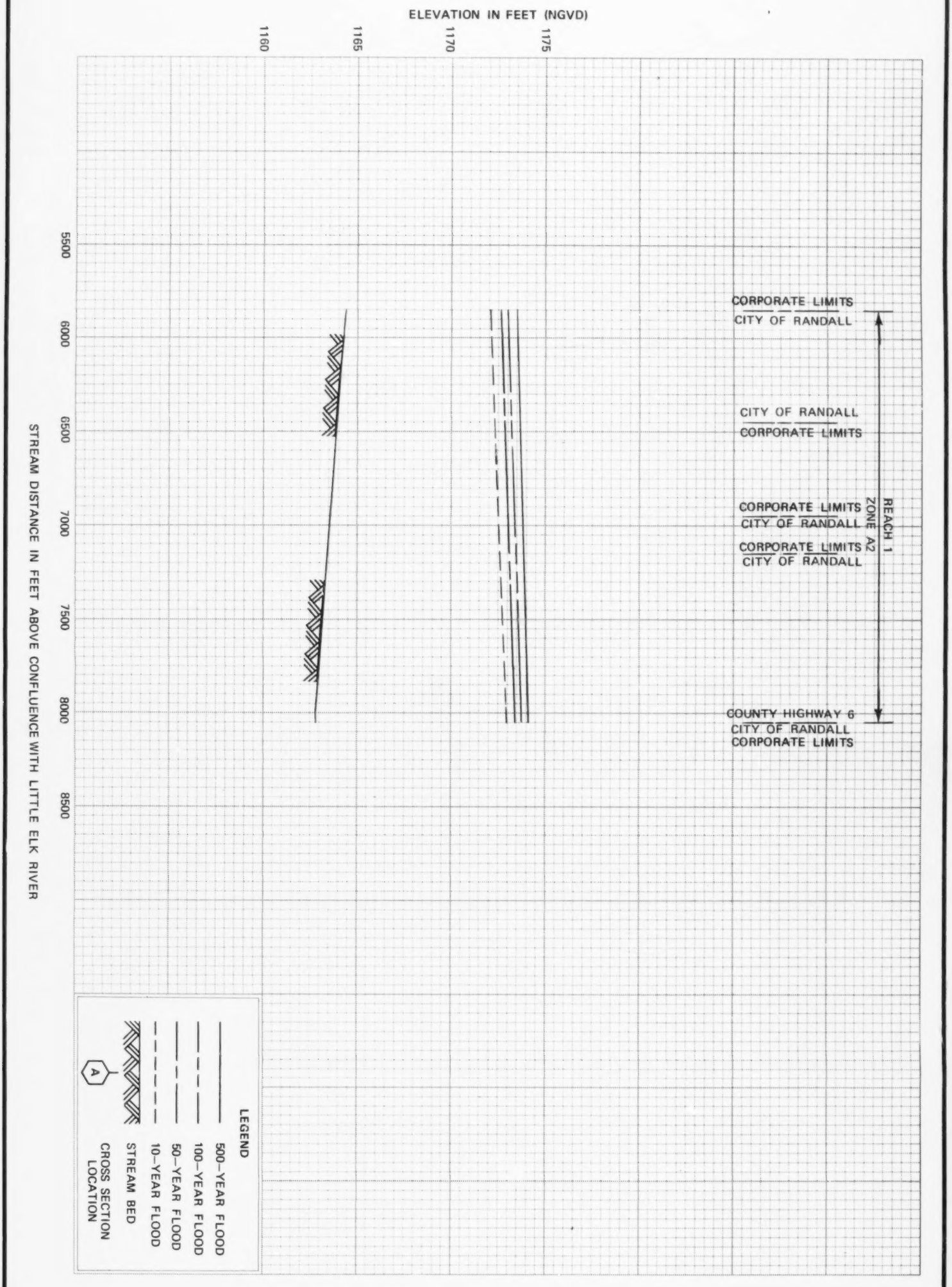
FLOOD PROFILES

LITTLE ELK RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

COUNTY OF MORRISON, MN
(UNINCORPORATED AREAS)

06P



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FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration
COUNTY OF MORRISON, MN
(UNINCORPORATED AREAS)

FLOOD PROFILES

SOUTH BRANCH LITTLE ELK RIVER